Neuropsychological and Intellectual Differences Between Types of Murderers : Affective/Impulsive Versus Predatory/ Instrumental (Premeditated) Homicide

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NEUROPSYCHOLOGICAL AND INTELLECTUAL DIFFERENCES BETWEEN TYPES OF MURDERERS

Affective/Impulsive Versus Predatory/ Instrumental (Premeditated) Homicide

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The notion that affective/impulsive violence and predatory/instrumental violence constitute distinct behavioral phenotypes has been supported in the forensic literature. Prior research suggests that offenders committing affective/impulsive homicide exhibit differing patterns of anomalous regional brain activation and decreased executive functions relative to predatory/instrumental homicide offenders. However, no prior research has examined the extent to which murderers who kill impulsively versus those who kill as the result of the execution of a premeditated strategic plan differ with regard to other neuropsychological functions and intelligence. Based on established criteria, we classified 77 murderers into affective/impulsive and predatory/instrumental groups, and compared their performance on standardized measures of intelligence and neuropsychological functioning. Results revealed significant differences between the affective/impulsive group (mean Full Scale IQ = 79) and the predatory/instrumental group (mean Full Scale IQ = 93) on indices of intelligence, memory, attention, and executive functioning. Most differences remained significant after controlling for relevant background factors.

Keywords: homicide; murder; neuropsychology; intelligence; premeditated violence

According to the Federal Bureau of Investigation, a total of 12,331 nonjustifiable homicides were reported to law enforcement authorities in the United States in 2010 (U.S. Department of Justice, 2011). It has been estimated that each murder is associated with more than $17.25 million in public costs (DeLisi et al., 2010), in addition to the immeasurable emotional cost to families and friends of homicide victims. Given the high

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societal and personal cost of homicide, it is not surprising that an impressive body of literature has amassed during the recent decades with regard to social, criminological, psychological, and biomedical characteristics of homicide offenders. This research has had direct implications for policy (e.g., development of preventative strategies), law enforcement (e.g., criminal investigation), the legal system (e.g., evaluating the risk of reoffending) and corrections (e.g., developing rehabilitative programs).

The notion that proactive and reactive types of violence represent distinct social, psychological, and neurological phenotypes has been supported in the literature. Although this classification has been applied to homicide offenders in the past (Amen, Hanks, Prunella, & Green, 2007; Declercq & Audenaert, 2011; Heilbrun, Heilbrun, & Heilbrun, 1978; Raine et al., 1998; Salfati & Canter, 1999), no prior study has examined whether offenders who commit proactive versus reactive types of murder are characterized by distinct neurocognitive profiles. To this end, we classified a sample of incarcerated homicide offenders into affective/impulsive (reactive) and predatory/instrumental (proactive) homicide groups according to a set of defined and replicated criteria. We then compared these two groups on standard measures of neuropsychological functioning, including general intelligence, memory, attention and executive functions. In the following paragraphs, we outline the definitions of predatory/instrumental and affective/impulsive violence and review published literature that highlights the distinction between these two groups.

It is generally accepted that not all violent behavior is the same, and criteria have been put forth over the years to classify violent behavior with respect to the reactive–proactive axis. Arguably of most direct relevance to forensic science is the affective/impulsive versus predatory/instrumental classification of violence, based on the autonomic, affective, psychological, and behavioral state of the individual at the time of the commission of the violent act (see appendix; Meloy, 1988, 1997). According to these criteria, affective/impulsive violence, as a defensive reaction to perceived threat, is preceded by high levels of autonomic arousal and accompanied by emotions of anger and fear. Conversely, predatory/instrumental violence is purposeful and proactive behavior, the goals of which vary in accordance with the perpetrator's motivation; it is not typically preceded by high autonomic arousal or accompanied by strong emotions. The affective/impulsive–predatory/instrumental classification has been validated in the animal (Siegel & Brutus, 1990; Siegel & Victoroff, 2009) and human (Tweed & Dutton, 1998; Vitacco, Neumann, & Caldwell, 2010) research literature, including homicide offenders (Declercq & Audenaert, 2011).

There is evidence from prior research linking affective/impulsive violence with neurocognitive and psychological dysfunction. Affective/impulsive homicide offenders were reported to have greater difficulty inhibiting prepotent responses under time pressure conditions than nonhomicide offenders, presumably implicating prefrontal cortex dysfunction in that population (Chen, Muggleton, Juan, Tzeng, & Hung, 2008). In fact, available findings from research examining regional brain activation in relation to affective/impulsive violence suggest hypoactivation in brain areas thought to underlie impulse control and other executive functions. Affective/impulsive homicide offenders have been shown to have decreased regional cerebral blood flow in the anterior cingulate and orbitofrontal cortices (Amen et al., 2007) and reduced amplitudes of evoked electroencephalographic response (N2) over the frontocentral cortex (Chen, Tien, Juan, Tzeng, & Hung, 2005) during go/no-go tasks. Similarly, homicide offenders pleading not guilty by reason of insanity (NGRI), regardless of the affective/impulsive–predatory/instrumental classification, have

been found to have reduced glucose metabolism in the prefrontal cortex, superior parietal gyrus, left angular gyrus, and the corpus callosum, as well as abnormal asymmetry of activation (left hemisphere lower than right hemisphere) in the amygdala, thalamus, and medial temporal lobe compared to nonmurderer controls (Raine, Buchsbaum, & LaCasse, 1997).

Psychologically, offenders who commit affective/impulsive crimes have been shown to have a wider range of serious psychopathology (Stanford, Houston, & Baldridge, 2008), as well as passive-aggressive, borderline, and avoidant personality characteristics, higher chronic anger, and fearful attachment (Tweed & Dutton, 1998). With regard to crime characteristics, affective/impulsive offenders are more likely to have a close relationship with their victim, to have felt provoked by the victim, and to have acted in a state of anger (Cornell et al., 1996). There is also indication that affective/impulsive homicide offenders are more likely than predatory/instrumental homicide offenders to violate conditions of parole (Heilbrun et al., 1978).

In contrast, behavioral research has suggested that predatory/instrumental homicide offenders demonstrate an intact capacity to regulate executive control processes, except when motivational factors are present, unlike affective/impulsive murderers who appear more dysfunctional in impulse-control tasks regardless of the presence or absence of motivational factors (Levi, Nussbaum, & Rich, 2010). In addition, offenders committing predatory/instrumental violence relative to those committing affective/impulsive violence tend to display higher psychopathic traits (Stanford et al., 2008), to commit more severe physical violence and manifest more antisocial-narcissistic-aggressive personality characteristics (Tweed & Dutton, 1998), and to have an identifiable goal in committing violence (Cornell et al., 1996). Predatory/instrumental homicide offenders tend to use instrumental violence (Woodworth & Porter, 2002); often have previous offenses of theft, burglary, and vehicle theft; tend to be unemployed; and have a record in the armed services, previous prison sentences, familiarity with the area of the crime, and a social connection to the victim (Salfati & Canter, 1999). Additionally, parolees who violated parole by committing a violent offense were more likely to have committed a predatory/instrumental murder (Heilbrun et al., 1978).

Very little is known about performance differences between the affective/impulsive and predatory/instrumental homicide offender groups on standard neuropsychological measures. There is some indication from recent research that homicide offenders with below-average scores on tests of executive functions (i.e., problem solving, cognitive flexibility, response inhibition) tend to follow offending pathways characterized by poor self-control and negative emotional responses to their crimes, whereas cognitively intact homicide offenders are characterized by premeditation and positive affect in response to their crimes (Gilligan & Lennings, 2010, 2012). However, this research was based on a relatively small ($N = 26$) sample of male offenders who had been found NGRI by the court, which limits the generalizability of these findings to the larger homicide offender population. Furthermore, these studies did not examine performance in other cognitive domains such as intellectual or memory functioning, or include symptoms validity tests (SVTs) as part of the neuropsychological assessment.

Only one study, to our knowledge, examined brain functioning in affective/impulsive versus predatory/instrumental homicide offenders classified using the Meloy (1988, 1997) criteria outlined above. Predatory/instrumental homicide offenders did not significantly differ from normal control subjects in prefrontal glucose metabolism as measured by positron

emission tomography during a continuous performance task; but they revealed significantly increased activity in right subcortical regions, including the amygdala, midbrain, hippocampus, and thalamus. In contrast, although affective/impulsive homicide offenders also revealed higher right subcortical activity, relative to normal controls, lateral and medial prefrontal activity was significantly decreased relative to normal controls and to predatory/instrumental murderers (Raine et al., 1998). The authors' interpretation of this finding was that control of violent behavior results from a dynamic balance between activation of subcortical and prefrontal regions, such that normal prefrontal but overactive subcortical activation in predatory/instrumental homicide offenders results in aggressive yet goal-oriented behavior, whereas decreased prefrontal functioning combined with increased subcortical activation results in affective/impulsive homicidal aggression (Raine et al., 1998).

In sum, evidence from past research suggests that offenders who commit affective/impulsive violence are characterized by significant neuropsychological dysfunction including behavioral disinhibition and below-average performance on some tests of executive functioning, varied but significant psychopathology, as well as abnormal activation of the prefrontal cortex and other brain areas involved in behavioral control and emotional regulation. In contrast, there is no consistent evidence linking predatory/instrumental violence to deficient impulse control, deficient neuropsychological test performance, or prefrontal abnormalities on neuroimaging. In addition, although Raine and colleagues (1998) reported differences in regional brain activation between affective/impulsive and predatory/instrumental homicide offenders classified using the Meloy (1988, 1997) criteria, no prior study to our knowledge has systematically examined the performance of these two offender groups on standardized neuropsychological measures of memory, executive functioning, and intellectual status. The present study was designed to address this gap. Based on prior findings, we hypothesized that affective/impulsive homicide offenders are characterized by significant neurocognitive dysfunction and manifest lower overall intellectual functioning, relative to predatory/instrumental homicide offenders. Conversely, we hypothesized that predatory/instrumental homicide offenders are not characterized by significant neurocognitive dysfunction and perform within normal limits on most standardized neuropsychological measures.

METHOD

PARTICIPANTS

The sample was comprised of 77 men and women charged with or convicted of first-degree murder in Illinois and Missouri. Collectively, these 77 individuals were charged with or convicted of the murders of 137 people. Regarding location, 70% of these individuals were evaluated while in custody at the Cook County Jail in Chicago, IL, and 30% were evaluated in other correctional facilities in Illinois and Missouri. All subjects were referred for a neuropsychological evaluation by attorneys or the court in relation to one of the following concerns: fitness to stand trial or criminal responsibility such as sanity during the guilt–innocence phase; mental retardation or neuropsychological abnormalities that represent potentially mitigating factors during the sentencing phase; or neuropsychological abnormalities that represent potentially mitigating factors during postconviction appeals.

All participants voluntarily consented to undergo a neuropsychological evaluation and were examined by the first author. All evaluations were conducted between 2000 and 2007. A detailed description of the sample has been published elsewhere (Hanlon, Rubin, Jensen, & Daoust, 2010). Briefly, participants were predominately African American (68%) and male (90%). Age ranged from 16 to 67 (M = 31.92), and participants had an average of 10.52 years of education (SD = 2.22). The majority of the sample (48 cases, 62%) was charged with or convicted of the murder of one individual (Hanlon et al., 2010). Of the other 29 participants, 27 were charged with or convicted of killing multiple individuals as part of a single act (i.e., double murders, triple murders, or mass murders). The remaining two participants were convicted of serial murders; for those participants, only the most recent homicide was coded.

AFFECTIVE/IMPULSIVE–PREDATORY/INSTRUMENTAL CLASSIFICATION

Meloy's forensic criteria (Meloy, 1988, 1997, 2000; 2006, see appendix) were used to classify participants into the affective/impulsive and predatory/instrumental murder groups. Ratings were made on the basis of detailed crime scene descriptions in police reports, known relationships between the victim and the offender, reports of psychological and psychiatric evaluations by forensic examiners, court transcripts, statements made by offenders to police investigators, and statements of confession made to examiners. Two independent raters who were blind to each other's ratings completed the classification. Interrater reliability was good (average intraclass r = .89, p < .001). Inconsistencies between raters were resolved through consensus. The classification resulted in 44 individuals who committed murders as a result of affective/impulsive homicidal aggression and 33 individuals who committed murders that were carried out based on a predatory/instrumental strategic plan.

NEUROPSYCHOLOGICAL TEST BATTERY

Information regarding education, medical history, psychiatric history, and criminal history were obtained from available educational, medical, psychiatric, and law enforcement/correctional records. All defendants underwent a clinical interview and were administered a battery of standardized neuropsychological tests. Intellectual functioning was assessed using the Wechsler Adult Intelligence Scale–Third Edition (WAIS-III; Psychological Corporation, 1998). Memory measures included the Logical Memory and Faces subtests of the Wechsler Memory Scale–Third Edition (WMS-III; Psychological Corporation, 1997) and the California Verbal Learning Test–Second Edition (CVLT-II; Delis, Kramer, Kaplan, & Ober, 2000). Measures of executive functioning included the Wisconsin Card Sorting Test (WCST; Heaton, Chelune, Talley, Kay, & Curtiss, 1993), the Conners' Continuous Performance Task II (CPT-II; Conners, 2000), the Trail Making Test (Reitan, 1958; Strauss, Sherman, & Spreen, 2006), the Stroop Color and Word Test (Golden & Freshwater, 2002), and the Controlled Oral Word Association Test (COWAT; Strauss et al., 2006).

Because neuropsychological assessment in criminal samples is often complicated by symptom exaggeration and/or malingering (Ardolf, Denney, & Houston, 2007; Denney, 2007, 2008; Rogers, 2008), the analyses included only data from participants who passed at least three of the following symptom validity tests: Word Memory Test (Green, 2005;

Green, Iverson, & Allen, 1999), Test of Memory Malingering (Tombaugh, 1996), Rey15-Item Memory Test (Rey, 1958; Reznek, 2005), or the Victoria Symptom Validity Test (Slick, Hopp, Strauss, & Thompson, 2005). If psychotic symptoms or diagnoses were revealed by self-report or record review, the Structured Interview of Reported Symptoms (SIRS; Rogers, Bagby, & Dickens, 1992) was completed to rule out psychiatric malingering. The reader is referred to Hanlon and others (2010) for the detailed description of symptom validity test cutoff scores.

STATISTICAL ANALYSES

Differences in demographic and clinical characteristics between offenders who committed affective/impulsive homicide and those who committed predatory/instrumental homicide were examined using independent *t* tests for continuous variables and chi-square (χ^2) tests for categorical variables. To investigate group differences in neuropsychological functioning, we first conducted a series of independent *t* tests. Subsequently, hierarchical multivariate regressions were used to test the associations between group and neuropsychological functioning after adjusting for relevant variables showing group differences. In step 1, we entered demographic and behavioral variables (covariates) differing between the two groups. These included age, education, race, history of developmental disorders, history of an Axis I psychiatric diagnosis (e.g., mood, anxiety, psychotic disorder), and history of an Axis II personality disorder. In step 2, group status was entered. All *p* values are two-sided, and the statistical significance level was set at $p = .05$. Statistical analyses were conducted using SPSS software (version 18.0 for Windows; SPSS, Chicago, IL).

RESULTS

DEMOGRAPHICS AND MEDICAL/PSYCHIATRIC HISTORY

Table 1 shows the demographic and behavioral variables as a function of group. Overall, the groups were similar across most demographic variables including current psychiatric and neurologic complaints, history of serious medical illness, neurotrauma (e.g., head injury), physical/sexual abuse, psychiatric treatment, and past delinquent behavior. However, compared to offenders who had committed predatory/instrumental homicides, offenders who had committed affective/impulsive homicides were younger, less educated, more likely to be African American and to have a history of substance abuse or developmental disorders, and less likely to have a history of psychiatric diagnosis or personality disorder.

INTELLECTUAL FUNCTIONING

Group comparisons and regression results for intellectual functions are presented in Table 2. Offenders who committed affective/impulsive murders were less intelligent than predatory/instrumental murderers as demonstrated by significantly lower Full Scale IQ (FSIQ), $t(75) = -4.84$; $d = 1.13$. Using the accepted IQ score qualitative descriptors (Psychological Corporation, 1998), the mean FSIQ of the predatory/instrumental group (93) was in the average range, whereas the affective/impulsive group had a mean FSIQ in

TABLE 1. Demographic Comparisons for the Affective/Impulsive and Predatory/Instrumental Homicide Offender Groups.

	Homicide Group	
	Affective/Impulsive (n = 44)	*Predatory/Instrumental (n = 33)*
Variables	*M (SD)*	*M (SD)*
Age†	29.93 (11.56)	34.58 (11.15)
Years of education**	9.91 (1.82)	11.33 (2.47)
Sex (% Male)	93	85
Race (%)*		
African American	80	52
Caucasian	9	33
Hispanic	11	12
Asian	—	3
History of Alcohol and/or Drug Abuse (%)*	93	76
History of Mood Disorder or Psychotic Disorder (%)*	34	61
Personality Disorder (%)†	46	67
Developmental Disorder (Mental Retardation, Learning Disorder) (%)*	59	36
ADHD or Disruptive Behavior Disorder (%)	43	27
History of using psychiatric medication (%)	11	3
Previous psychiatric treatment (%)	43	46
Current psychiatric complaints (%)	75	61
Self-reported history of head trauma (%)	90	82
Current neurological complaints (%)	89	79
Abuse (sexual, physical, both) (%)	30	42
Significant Medical History (%)	61	55
Current sensory complaints (%)	57	67
History of Delinquency (%)	64	61
Criminal History (%)	52	61
History of Violence (%)	46	39
Juvenile Crimes (%)	39	36

†$p = .05$. *$p < .05$. **$p < .01$.

the borderline range (79). Similarly large effect sizes were observed for Verbal (VIQ), $t(75) = -4.40$; $d = -1.03$, and Performance (PIQ), $t(75) = -4.26$; $d = -.98$, intelligence composite scores, as well as the Verbal Comprehension (VCI), $t(75) = -4.26$; $d = -.95$, Working Memory (WMI), $t(75) = -3.31$; $d = -.73$, Perceptual Organization (POI), $t(75) = -4.30$; $d = -.97$, and Processing Speed (PSI), $t(75) = -3.64$; $d = -.81$, index scores. In fact, affective/impulsive murderers scored significantly lower across WAIS-III subtests (see Table 2). Following regression analyses, group differences on FSIQ, VIQ, PIQ, VCI, POI, and PSI remained significant after accounting for demographic and other background variables, although the difference on WMI became nonsignificant.

MEMORY

Group comparisons and regression results for memory scores are presented in Table 3. Offenders who committed affective/impulsive murder had significantly poorer recall of

TABLE 2. Intellectual Functioning (WAIS-III): Group Comparison and Regression Results for the Affective/Impulsive and Predatory/Instrumental Homicide Groups.

	Group Comparison: Unadjusted M (SD)		
WAIS-III Index/Subtest	*Affective/Impulsive (n = 44)*	*Predatory/Instrumental (n = 33)*	β
Full Scale IQ	78.86 (10.26)***	93.00 (15.35)	.32***
Verbal IQ	80.38 (10.68)***	93.00 (14.51)	.24*
VCI	82.19 (11.57)***	93.77 (13.20)	.23*
Vocabulary	6.30 (2.30)***	8.60 (2.78)	.20
Information	7.25 (2.48)***	9.32 (2.74)	.16
Similarities	6.95 (2.13)***	8.92 (2.46)	.21
WMI	83.49 (10.30)**	91.55 (12.18)	.12
Arithmetic	6.95 (2.30)***	9.17 (3.21)	.18
Digit Span	7.48 (1.81)*	8.34 (1.95)	.05
LNS	7.41 (2.16)**	8.85 (2.31)	.16
Performance IQ	80.67 (9.80)***	93.39 (16.52)	.36**
POI	83.41 (8.85)***	95.62 (16.67)	.36**
Picture Comp	7.44 (2.11)***	9.54 (3.12)	.35**
Block Design	7.14 (2.00)***	9.46 (2.96)	.35**
Matrix Reason	7.80 (2.52)*	9.12 (2.80)	.15
PSI	78.84 (11.22)***	88.81 (13.88)	.30*
Digit Symbol	5.77 (2.31)**	7.55 (2.84)	.29*
Symbol Search	6.20 (2.46)**	8.25 (2.77)	.25*

Note. WAIS-III = Wechsler Adult Scale of Intelligence–Third Edition; VCI = Verbal Comprehension Index; WMI = Working Memory Index; POI = Perceptual Organization Index; PSI = Processing Speed Index; LNS = Letter-Number Sequencing. All scores are demographically corrected. β = standardized regression coefficient for homicide type on WAIS-III scores after accounting for age, education, race, developmental disorder, Axis I psychiatric diagnosis, and Axis II personality disorder.
*$p < .05$. **$p < .01$. ***$p < .001$.

contextually unrelated verbal information (i.e., word list) across various indices. Specifically, affective/impulsive murderers learned fewer words during repeated administrations of the list (CVLT-II total learning score), $t(50) = -3.73$; $d = -1.05$, and recalled fewer words after both short (1-2 min), $t(48) = -3.28$; $d = -.95$), and long (20 min), $t(50) = -3.24$; $d = -.93$, delay intervals. Likewise, affective/impulsive murderers had poorer recall for narrative verbal information (i.e., short stories), both when assessed immediately after presentation (WMS-III Logical Memory Immediate), $t(66) = -3.75$; $d = -.94$, and following a 30-min delay (WMS-III Logical Memory Delayed), $t(66) = -4.16$; $d = -1.03$. Group differences on measures of visual–nonverbal recognition memory for faces were significant but more modest than in the verbal domain, with affective/impulsive murderers exhibiting poorer recognition performance when asked to recognize pictures of faces immediately after presentation (WMS-III Face Recognition), $t(66) = -3.16$; $d = -.78$. These group differences remained significant after accounting for demographic and other background variables. The group difference for delayed face recognition performance did not approach significance despite its moderate effect size ($d = -.41$).

ATTENTION AND EXECUTIVE FUNCTIONS

Group comparisons and regression results for attention and executive function scores are presented in Table 4. Offenders who committed affective/impulsive murder exhibited

TABLE 3. Memory Functioning: Group Comparison and Regression Results for the Affective/Impulsive and Predatory/Instrumental Homicide Groups.

	Group Comparison: Unadjusted M (SD)				
	Affective/Impulsive		*Predatory/Instrumental*		
Memory Index	*n*	*M (SD)*	*n*	*M (SD)*	β
WMS-III					
Logical Memory					
Immediate	39	6.92 (2.02)***	29	8.90 (2.30)	.30**
Delayed	39	7.03 (2.01)***	29	9.10 (2.08)	.41**
Face Recognition					
Immediate	38	7.92 (2.07)**	30	9.63 (2.40)	.39**
Delayed	38	9.03 (2.28)	30	10.00 (2.56)	.21
CVLT-II					
Encoding	25	35.12 (10.68)***	27	45.89 (10.16)	.40**
Short delay	25	–1.22 (0.98)**	25	–0.24 (1.13)	.40**
Long delay	25	–1.62 (0.75)**	27	–0.84 (0.95)	.39**

Note. WMS-III = Wechsler Memory Scale–Third Edition, Logical (story) Memory and Face Recognition immediate and delayed (25-min) recall scaled scores; CVLT-II = California Verbal Learning Tests–Second Edition, Encoding (total words recalled on trials 1-5, *T*-score), Short Delay (total words recalled after distractor trial, *z* score), Long Delay (total words recalled after 20-min delay, *z* score). All scores are demographically corrected. β = standardized regression coefficient for homicide type on memory scores after accounting for age, education, race, developmental disorder, Axis I psychiatric diagnosis, and Axis II personality disorder.
**$p < .01$. ***$p < .001$.

overall poorer performance on indices of attention compared to the predatory/instrumental group. Specifically, affective/impulsive murderers showed slower completion times on a measure of speeded visual–motor attention and scanning, Trail Making A, $t(69) = -3.47$; $d = -.84$. On the CPT-II, a measure of sustained attention and vigilance, the affective/impulsive group had a lower pass rate and committed a greater number of omission errors, $t(58) = 3.18$; $d = .86$ [both the t statistic and the effect side d should be positive]. These differences remained significant after controlling for demographic and other background variables.

Results were mixed with regard to group differences on indices of executive functioning. On the WCST, a measure of novel problem solving requiring concept formation and hypothesis testing, the two groups did not differ significantly on the number of categories completed ($d = -.33$), although the affective/impulsive group committed a greater number of errors, $t(66) = -2.20$; $d = -.55$, indicating a less efficient approach to problem solving. Affective/impulsive murderers also showed a reduced capacity for cognitive flexibility and conceptual alternation, Trail Making B, $t(71) = -2.52$; $d = -.61$; and poorer generative fluency, COWAT, $t(68) = -2.16$; $d = -.53$). After accounting for demographic and other background variables, the difference on the WCST remained, whereas the differences on Trail Making B and the COWAT became nonsignificant. No statistically significant group differences were observed on traditional measures of response inhibition and impulsivity, including the Color–Word Interference index from the Stroop test ($d = -.38$) and the number of commission errors on the CPT-II ($d = .44$), despite the nontrivial effect sizes.

TABLE 4. Attention and Executive Functioning: Group Comparison and Regression Results for the Affective/Impulsive and Predatory/Instrumental Homicide Groups.

	Group Comparison: Unadjusted M (SD)				
	Affective/Impulsive		*Predatory/Instrumental*		
Attention/Executive Function Index	*n*	*M (SD)*	*n*	*M (SD)*	β
Trail Making Test (*T*-scores)					
Trail Making A	40	39.90 (9.87)***	31	47.55 (8.30)	.46***
Trail Making B	42	36.74 (12.10)*	31	43.61 (10.66)	.22
CPT-II					
Pass/Fail Test (% pass)	37	22*	22	50.00	.34**
Omission errors (%ile)	37	78.86 (27.43)**	23	54.89 (29.82)	–.39**
Commission errors (%ile)	37	57.55 (31.88)	23	44.01 (30.38)	–.08
COWAT					
Total words (%ile)	41	24.49 (22.39)*	29	36.90 (25.52)	.22
WCST					
Categories completed	39	3.69 (2.28)	29	4.38 (1.94)	.21
Total errors (%ile)	39	26.27 (26.07)*	29	42.29 (33.95)	.33*
Perseverative response (%ile)	39	35.73 (31.25)	29	46.29 (36.56)	.22
Nonperseverative errors (%ile)	38	31.92 (27.68)	29	36.50 (29.58)	.09
Number of set failures	38	1.58 (1.63)	29	1.31 (1.49)	.04
Stroop Test (*T*-scores)					
Word Reading	34	38.91 (7.29)*	26	43.27 (7.62)	.21
Color Naming	34	39.15 (6.89)	26	41.88 (6.39)	.11
Color-Word Interference	34	35.88 (6.80)	26	38.69 (8.36)	.01

Note. CPT-II = Continuous Performance Test-2; COWAT = Controlled Oral Word Association Test; WCST = Wisconsin Card Sorting Test. All scores are demographically corrected. β = standardized regression coefficient for homicide type on executive functioning after accounting for age, education, race, developmental disorder, Axis I psychiatric diagnosis, and Axis II personality disorder. For the CPT-II, higher percentile scores indicate poorer performance for omission and commission errors. For the COWAT and WCST, lower percentile scores indicate poorer performance across indices.
*$p < .05$. **$p < .01$. ***$p < .001$.

DISCUSSION

The current study is, to our knowledge, the first to compare intellectual status and neuropsychological functions among individuals committing affective/impulsive and predatory/instrumental homicide, in a single offender sample. As predicted, affective/impulsive murderers demonstrated significantly poorer performance than predatory/instrumental murderers across neurocognitive domains, with the largest effect sizes observed on measures of intelligence, memory, attention, and executive functions, in that order (see Figure 1). Most of these differences remained significant after controlling for the influence of demographic and other background variables. Although there were no statistically significant group differences on measures of response inhibition, affective/impulsive murderers demonstrated clinically significant deficits on these measures. In contrast, predatory/instrumental murderers showed largely intact functioning across neurocognitive domains.

The current findings provide preliminary evidence for the neurobehavioral subtyping of murderers. Utilizing the Meloy (1988, 1997) criteria regarding affective/impulsive and predatory/instrumental violence to classify subtypes of murderers, we determined preliminary neuropsychological profiles of affective/impulsive murderers and predatory/instrumental

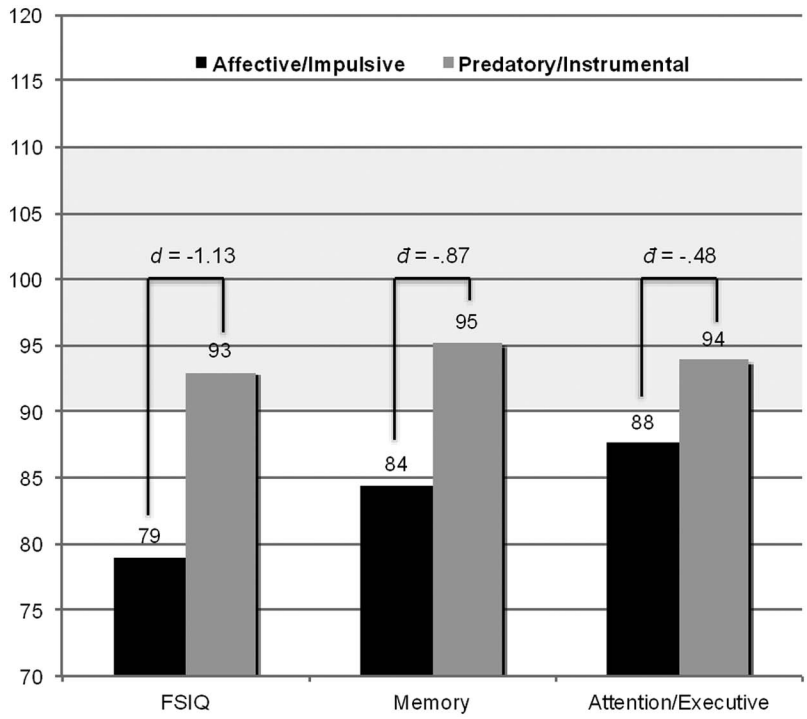

Figure 1. Neuropsychological Differences Between Affective/Impulsive and Predatory/Instrumental Homicide Offenders by Global Domain

Note. Bars represent Standard Scores (M = 100, SD = 15). Shaded region represents the average performance range according to accepted guidelines (Psychological Corporation, 1998). FSIQ = Full Scale IQ (WAIS-III); d = Cohen's effect size for performance of affective/impulsive vs. predatory/instrumental homicide offenders (negative d indicates poorer performance in the affective/impulsive group); $\bar{d}$ = pooled effect size across cognitive measures within each global domain.

murderers. Specifically, offenders who committed murder as a result of an affective/impulsive act were undereducated, relative to the general population (U.S. Census Bureau, 2009), with a history of neurodevelopmental disorders (e.g., learning disorder, mental retardation, borderline intellectual functioning) and chronic substance abuse (i.e., alcohol abuse/dependence and/or drug abuse/dependence), combined with relatively low intelligence (mean Full Scale IQ = 79) and multiple neurocognitive deficits, including attentional dysfunction, an abnormally slow rate of information processing, deficient verbal memory functions, and executive dysfunction.

In contrast, offenders who committed murder as a result of the execution of a predatory/instrumental strategic plan were of average intelligence (mean Full Scale IQ = 93), without significant neurocognitive dysfunction, but with higher rates of both Axis I psychiatric disorders and personality disorders, relative to affective/impulsive murderers. Although both subtypes were characterized by high rates of substance abuse, the affective/impulsive murders were characterized by a significantly higher rate of substance abuse (93%), relative to the predatory/instrumental murderers (76%) in the current study (see Table 1). Perhaps more importantly, the statistical differences between the two groups regarding intelligence and neurocognitive functions remained after controlling for the effect of substance abuse.

From a neuropsychological perspective, the current findings are consistent with and extend prior findings (Gilligan & Lennings, 2010, 2012; Raine et al., 1998) regarding the neurocognitive differences between affective/impulsive and predatory/instrumental murderers. Raine and colleagues (1998) demonstrated normal regional brain activation in predatory/instrumental murderers during engagement in a CPT task, in contrast to affective/impulsive murderers who demonstrated significantly decreased bilateral prefrontal activation relative to normal controls and predatory/instrumental murderers. The neurocognitive characteristics of the affective/impulsive murderers in the current study—involving attentional dysfunction, defective rate of information processing, deficient memory encoding of verbal information, and selective executive dysfunction—support the neurophysiological model of deficient prefrontal activation among affective/impulsive murderers. Similarly, the relatively normal neurocognitive status of the predatory/instrumental murders in the current study is consistent with relatively normal prefrontal activation, despite the increased activation of right hemisphere subcortical structures demonstrated in the study by Raine and colleagues (1998) study. The current results also replicate the Gilligan and Lennings (2010, 2012) findings of deficient performance on tests of executive functions in affective/impulsive (but not predatory/instrumental) offenders, and extend their findings by providing additional evidence of cognitive impairment in the affective/impulsive group on tests of intellectual functioning, memory, and sustained attention/vigilance. Furthermore, the inclusion of SVTs in the current study allows for firmer conclusions regarding the observed performance deficits being associated with neurocognitive dysfunction in the affective/impulsive group, rather than poor effort or symptom exaggeration.

Despite the consistency between the prior findings of Raine and others (1998) and Gilligan and Lennings (2010, 2012) and the neuropsychological findings of the current study, there were notable differences between the samples of murderers assessed. In both the Raine and colleagues (1998) and the Gilligan and Lennings (2010, 2012) studies, all of the subjects pleaded and/or were found NGRI or incompetent to stand trial; as a result, they were confined to forensic hospitals. Conversely, only one subject in the current sample was ultimately found to be NGRI by the court. Similarly, although a few subjects in the current sample were considered unfit to stand trial following evaluations by forensic examiners and subsequently underwent therapeutic programming aimed at restoration of fitness, all of the subjects in the current sample were ultimately considered fit to stand trial by the court. As such, whereas all of the subjects used in prior research were forensic hospital detainees, all of the subjects in the current study were incarcerated in county jails or state prisons. In summary, although the subjects in the prior and current studies were very similar with respect to their violent criminal offenses (i.e., murder), the subjects in the current study constitute a more representative sample of murderers, in general, than those used in previous research.

Premeditation, by definition, is a cognitive concept that denotes “conscious consideration and planning that precedes some act,” whereas an impulse, by definition, is a behavioral concept that denotes “a sudden urge or inclination that prompts an unplanned action” (Garner, 2001). Similarly, Meloy (1988, 1997) defines predatory/instrumental violence as a planned, purposeful, and primarily cognitively derived act, whereas affective/impulsive violence refers to reactive, immediate, and primarily emotionally derived acts (see appendix).

The current findings provide further validation of the Meloy criteria in an independent forensic sample.

Many jurisdictions within the United States (e.g., Florida), including the federal government, define first degree murder by statute as murder that is willful and premeditated. Some jurisdictions define first degree murder as intentionally killing and knowing that one's actions will cause death, whereas premeditation is considered an aggravating factor (e.g., Illinois). Other jurisdictions define murder, in general, as intentionally and knowingly causing the death of another and have eliminated the term premeditation from the statute (e.g., Texas). Still other jurisdictions define murder as the intentional killing of another individual with malice aforethought (e.g., California). Regardless of the jurisdiction, the terms used to define murder invariably include cognitive concepts, such as intent, knowing, premeditation, and the archaic aforethought.

Legally, the cognitive concepts of intent, knowing, premeditation, and aforethought constitute the mental state at the time of the crime and underlie the legal concept for mens rea, which infers the degree of culpability in legal proceedings. Clearly, the predatory/instrumental murderers in the current study were considered to have committed their crimes with specific intent, involving the execution of a premeditated strategic plan directed toward a specific victim or victims. Conversely, it may be argued that given the neurocognitive limitations that characterized the affective/impulsive murderers, they may have possessed a limited mental capacity for formulating specific intent, despite their apparent general intent.

There are several limitations to this study. The current study sample consisted of murderers incarcerated in Illinois and Missouri, and as such may not be representative of the greater homicide offender population; future research is needed to replicate the current findings in other locales and jurisdictions. Similarly, the exclusion of participants who failed symptom validity testing from the current analyses may have further resulted in a study sample that is underrepresentative of the target population; however, this exclusion criterion was necessary to ensure that any observed group differences were valid and not artificially inflated by suboptimal effort or malingering. Also, we chose the Meloy (1988, 1997) criteria to classify study participants into the affective/impulsive and predatory/instrumental groups as the most theoretically rigorous and empirically validated classification system; however, a substantial portion of extant research is based on other similar but distinct classifications of affective/impulsive and predatory/instrumental violence, which may partially limit direct comparison between those studies and the current findings. Relatedly, there is indication from prior research that some offenders tend to commit acts of both affective/impulsive and predatory/instrumental violence in the course of their criminal careers (Cornell et al., 1996; Flight & Forth, 2007). Because this issue has not been addressed with regard to homicide specifically, further research is needed to examine whether homicide offenders who commit both types of murder differ from the affective/impulsive and predatory/instrumental groups in terms of neuropsychological outcomes. In any case, because only two cases in our sample were serial murderers, this limitation is not likely to have significantly affected our results. Lastly, future research should examine differences between affective/impulsive and predatory/instrumental homicide offenders on important legal outcome variables, such as conviction and sentencing outcomes, recidivism, and criminal versatility.

APPENDIX

Meloy (1988, 1997) Criteria for Classifying Affective/Impulsive and Predatory/Instrumental Types of Violence

Affective/Impulsive Violence	*Predatory/Instrumental Violence*
Intense autonomic arousal	Minimal or absent autonomic arousal
Subjective experience of emotion	No conscious emotion
Reactive and immediate violence	Planned or purposeful violence
Internal or external perceived threat	No imminent perceived threat
Goal is threat reduction (homeostasis)	Variable goals
Possible displacement of target	No displacement of target
Time-limited behavioral sequence	No time-limited sequence
Preceded by instinctual behaviors to reduce threat	Preceded by private ritual to fuel narcissism/reduce paranoia
Primarily emotional/defensive	Primarily cognitive/attack
Heightened and diffuse awareness	Heightened and focused awareness

REFERENCES

Amen, D. G., Hanks, C., Prunella, J. R., & Green, A. (2007). Regional cerebral blood flow in impulsive murderers. *Journal of Neuropsychiatry and Clinical Neurosciences*, *19*, 304-309.

Ardolf, B. R., Denney, R. L., & Houston, C. M. (2007). Base rates of negative response bias and malingered neurocognitive dysfunction among criminal defendants referred for neuropsychological evaluation. *The Clinical Neuropsychologist*, *21*, 899-916. doi:10.1080/13825580600966391

Chen, C., Muggleton, N., Juan, C., Tzeng, O., & Hung, D. (2008). Time pressure leads to inhibitory control deficits in impulsive violent offenders. *Behavioural Brain Research*, *187*, 483-488.

Chen, C., Tien, Y., Juan, C., Tzeng, O., & Hung, D. (2005). Neural correlates of impulsive-violent behavior: An event-related potential study. *Neuroreport*, *16*, 1213-1216.

Conners, C. K. (2000). Conners' *Continuous Performance Test II: Computer Program for Windows Technical Guide and Software Manual*. North Tonawanda, NY: Multi-Health Systems.

Cornell, D. G., Warren, J., Hawk, G., Stafford, E., Oram, G., & Pine, D. (1996). Psychopathy in instrumental and reactive violent offenders. *Journal of Consulting and Clinical Psychology*, *64*, 783-790. doi:10.1037/0022-006x.64.4.783

Declercq, F., & Audenaert, K. (2011). Predatory violence aiming at relief in a case of mass murder: Meloy's criteria for applied forensic practice. *Behavioral Sciences and the Law*, *29*, 578-591. doi:10.1002/bsl.994

Delis, D. C., Kramer, J. H., Kaplan, E., & Ober, B. A. (2000). *California Verbal Learning Test–Second Edition*. San Antonio, TX: Pearson.

DeLisi, M., Kosloski, A., Sween, M., Hachmeister, E., Moore, M., & Drury, A. (2010). Murder by numbers: Monetary costs imposed by a sample of homicide offenders. *Journal of Forensic Psychiatry and Psychology*, *21*, 501-513. doi:10.1080/14789940903564388

Denney, R. L. (2007). Assessment of malingering in criminal forensic neuropsychological settings. In K. B. Boone (Ed.), *Assessment of feigned cognitive impairment: A neuropsychological perspective* (pp. 428-452). New York, NY: Guilford Press.

Denney, R. L. (2008). Negative response bias and malingering during neuropsychological assessment in criminal forensic settings. In R. L. Denney & J. P. Sullivan (Eds.), *Clinical neuropsychology in the criminal forensic setting* (pp. 91-134). New York, NY: Guilford Press.

Flight, J. I., & Forth, A. E. (2007). Instrumentally violent youths: The roles of psychopathic traits, empathy, and attachment. *Criminal Justice and Behavior*, *34*, 739-751. doi:10.1177/0093854807299462

Garner, B. A. (2001). *Black's law dictionary* (2nd ed.). St. Paul, MN: West Group.

Gilligan, D. G., & Lennings, C. J. (2010). Psychopathic and neuropathic pathways to homicide: Examination of Harris and Rice's two-path model of criminal violence in homicide. *Psychiatry, Psychology and Law*, *17*, 148-168. doi:10.1080/13218710903427875

Gilligan, D. G., & Lennings, C. J. (2013). Approach–avoidance goals and active–passive self-regulation styles in homicide offending: A pathways analysis. *Psychiatry, Psychology and Law*, 18 pp. Online publication. Retrieved at http://dx.doi.org/10.1080/13218719.2012.727074

Golden, C. J., & Freshwater, S. M. (2002). *Stroop Color and Word Test*. Wood Dale, IL: Stoelting.

Green, P. (2005). *Word Memory Test for Windows: User's manual and program*. Edmonton, Alberta, Canada: Green.
Green, P., Iverson, G. L., & Allen, L. (1999). Detecting malingering in head injury litigation with the Word Memory Test. *Brain Injury*, *13*, 813-819. doi:10.1080/026990599121205
Hanlon, R. E., Rubin, L. H., Jensen, M., & Daoust, S. (2010). Neuropsychological features of indigent murder defendants and death row inmates in relation to homicidal aspects of their crimes. *Archives of Clinical Neuropsychology*, *25*, 1-13. doi:10.1093/arclin/acp099
Heaton, R. K., Chelune, G. J., Talley, J. L., Kay, G. G., & Curtiss, G. (1993). *Wisconsin Card Sorting Test*. Odessa, FL: Psychological Assessment Resources.
Heilbrun, A. B., Heilbrun, L. C., & Heilbrun, K. L. (1978). Impulsive and premeditated homicide: An analysis of subsequent parole risk of the murderer. *The Journal of Criminal Law and Criminology*, *69*, 108-114.
Levi, M. D., Nussbaum, D. S., & Rich, J. B. (2010). Neuropsychological and personality characteristics of predatory, irritable, and nonviolent offenders: Support for a typology of criminal human aggression. *Criminal Justice and Behavior*, *37*, 633-655. doi:10.1177/0093854810362342
Meloy, J. R. (1988). *The psychopathic mind: Origins, dynamics, and treatment*. Lanham, MD: Jason Aronson.
Meloy, J. R. (1997). Predatory violence during mass murder. *Journal of Forensic Sciences*, *42*, 326-329.
Meloy, J. R. (2000). *Violence risk and threat assessment: A practical guide for mental health and criminal justice professionals*. San Diego, CA: Specialized Training Services.
Meloy, J. R. (2006). Empirical basis and forensic application of affective and predatory violence. *Australian and New Zealand Journal of Psychiatry*, *40*, 539–547.
Psychological Corporation. (1997). *Wechsler Memory Scale–Third Edition*. San Antonio, TX: Harcourt Brace.
Psychological Corporation. (1998). *Wechsler Adult Intelligenge Scale–Third Edition*. San Antonio, TX: Harcourt Brace.
Raine, A., Buchsbaum, M., & LaCasse, L. (1997). Brain abnormalities in murderers indicated by positron emission tomography. *Biological Psychiatry*, *42*, 495-508.
Raine, A., Meloy, J. R., Bihrle, S., Stoddard, J., LaCasse, L., & Buchsbaum, M. S. (1998). Reduced prefrontal and increased subcortical brain functioning assessed using positron emission tomography in predatory and affective murderers. *Behavioral Sciences and the Law*, *16*, 319-332.
Reitan, R. M. (1958). Validity of the Trail Making Test as an indicator of organic brain damage. *Perceptual and Motor Skills*, *8*, 271-276. doi:10.2466/pms.8.7.271-276
Rey, A. (1958). *L'examen clinique en psychologie* [The psychological examination]. Paris: Presses Universitaries de France.
Reznek, L. (2005). The Rey 15-item memory test for malingering: A meta-analysis. *Brain Injury*, *19*, 539-543. doi:10.1080/02699050400005242
Rogers, R. (2008). *Clinical assessment of malingering and deception* (3rd ed.). New York, NY: Guilford Press.
Rogers, R., Bagby, R. M., & Dickens, S. E. (1992). *Structured interview of reported symptoms*. Odessa, FL: Psychological Assessment Resources.
Salfati, C. G., & Canter, D. V. (1999). Differentiating stranger murders: Profiling offender characteristics from behavioral styles. *Behavioral Sciences and the Law*, *17*, 391-406.
Siegel, A., & Brutus, M. (1990). Neural substrates of aggression and rage in the cat. In A. N. Epstein & A. R. Morrison (Eds.), *Progress in psychobiology of physiological psychology* (pp. 135-233). San Diego, CA: Academic Press.
Siegel, A., & Victoroff, J. (2009). Understanding human aggression: New insights from neuroscience. *International Journal of Law and Psychiatry*, *32*, 209-215. doi:10.1016/j.ijlp.2009.06.001
Slick, D., Hopp, G., Strauss, E., & Thompson, G. B. (2005). *Victoria Symptom Validity Test*. Odessa, FL: Psychological Assessment Resources.
Stanford, M. S., Houston, R. J., & Baldridge, R. M. (2008). Comparison of impulsive and premeditated perpetrators of intimate partner violence. *Behavioral Sciences and the Law*, *26*, 709-722. doi:10.1002/bsl.808
Strauss, E., Sherman, E. M. S., & Spreen, O. (2006). *A compendium of neuropsychological tests: Administration, norms, and commentary* (3rd. ed). New York, NY: Oxford University Press.
Tombaugh, T. N. (1996). *Test of Memory Malingering*. North Tonawanda, NY: Multi-Health Systems.
Tweed, R. G., & Dutton, D. G. (1998). A comparison of impulsive and instrumental subgroups of batterers. *Violence and Victims*, *13*, 217-230.
U.S. Census Bureau. (2009). *American community survey: Educational attainment in the United States*. Retrieved July 30, 2012, from http://www.census.gov/prod/2012pubs/p20-566.pdf
U.S. Department of Justice, Federal Bureau of Investigation. (2011). *Crime in the United States, 2010*. Retrieved September 29, 2011, from http://www.fbi.gov/about-us/cjis/ucr/crime-in-the-u.s/2010/crime-in-the-u.s.-2010
Vitacco, M. J., Neumann, C. S., & Caldwell, M. F. (2010). Predicting antisocial behavior in high-risk male adolescents: Contributions of psychopathy and instrumental violence. *Criminal Justice and Behavior*, *37*, 833-846. doi:10.1177/0093854810371358
Woodworth, M., & Porter, S. (2002). In cold blood: Characteristics of criminal homicides as a function of psychopathy. *Journal of Abnormal Psychology*, *111*, 436-445. doi:10.1037//0021-843x.111.3.436

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